For several years, the North Carolina Division of Air Quality has operated two ambient air monitoring stations in eastern North Carolina, collecting continuous data on atmospheric concentrations of TGM. The first site, at Pettigrew State Park in northeastern North Carolina, collected data on TGM levels during the summer of 1996. The second site, at Lake Waccamaw State Park in southeastern North Carolina, has collected data since December of 1997. Both locations are situated in rural/remote areas at least 25 kilometers from any significant source of mercury emissions. However, the Waccamaw site is situated approximately 50 kilometers west of Wilmington, NC and may also be affected by major release points in the area, including waste incinerators, coal-fired utility boilers and a mercury cell chlor-alkali operation.

Following the analysis of early data from the Waccamaw and Pettigrew sites, additional monitoring locations were established in Riegelwood, NC, an industrial area located between Lake Waccamaw and Wilmington, NC. Measurement of RGM was initiated at one of these sites in March of 2000.

In this paper we describe the results from these atmospheric monitoring studies, as well as results from measurement of mercury in rainwater collected at Lake Waccamaw and Pettigrew State Parks in support of the national Mercury Deposition Network. We also discuss our experiences with relatively new techniques to continuously measure atmospheric RGM in ambient air over long time periods. Finally, we attempt to relate notable changes in ambient air mercury trends to significant changes in local and regional use patterns.

EXPERIMENTAL

Ambient air TGM was measured using Tekran Model 2537A mercury vapor analyzers (Tekran, 1999a). These instruments allow for sub-ng/m^3 analysis of mercury in air by first trapping mercury vapor passed over an ultra-pure gold adsorbent, then thermally desorbing the trapped mercury for measurement by Cold Vapor Atomic Fluorescence Spectrometry. The dual cartridge design allows for continuous monitoring by alternating mercury sampling and desorption/measurement. The instruments were housed in temperature-controlled enclosures, maintained between 20^0C and 30^0C. Ambient air was drawn through ¼ inch heated Teflon tubing containing two 0.2 μm particulate filters in the sample line. The instruments were programmed to initiate automatic calibrations by way of an internal injection from a mercury vapor permeation source every 25 hours. Data are not presented if the area difference between internal calibrations exceeded 5 percent. The instruments were programmed to measure mercury levels every 5 or 15 minutes, depending on the location, using a flow rate of 1.5 L of air per minute. Ambient air mercury was measured continuously, except under unusual circumstances such as instrument failure, power outages or hurricane conditions.

Ambient air RGM was measured using a Tekran Model 1130 Mercury Speciation Unit, a front-end accessory for the Tekran 2537A (Tekran, 1999b). The system uses an annular denuder coated with potassium chloride that traps RGM while allowing elemental mercury vapor to pass through to the detector unit. RGM is then released to the sample line as mercury vapor by heating the denuder to 500^0C for 15 minutes, once every two hours. The denuder inlet was placed at a height of 5 m above ground level for all sampling. Denuder assemblies were replaced on a weekly basis.

Meteorological stations were erected at the Waccamaw and Riegelwood locations. All sites were equipped to continually measure temperature, wind speed and wind direction